Workshop: 2nd ESA Workshop on Tracking, Telemetry, and Command Systems for Space Applications

Topic: Spacecraft Tracking

Title: Regenerative Pseudo-Noise Ranging for Deep Space Applications

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Currently, ranging for deep space missions is performed by turning around the uplink ranging modulation and re-modulating it onto the downlink carrier. This method results in about 1.5 MHz of noise also being modulated onto the downlink, severely degrading the received ranging SNR on the ground. This degradation must be compensated for by either increasing the integration time of the received signal, which increases the length of time for the track, or increasing the downlink ranging signal's modulation index, which decreases the power available for the telemetry modulation.

A method for the regeneration on the spacecraft of a pseudo-noise (PN) ranging signal has been developed. This method allows for an increase of up to 30 dB in the received downlink ranging power. The increased power can be used to decrease the measurement uncertainty, reduce the time of the measurement, or increase the power allocated to the downlink telemetry. This system was implemented in the Spacecraft Transponding Modem that was developed by JPL for NASA.